

Claims Amendments

Please amend claims 1-2 and cancel claim 3 as follows:

1. (Currently amended) A linear type actuator comprising:
 - a stator unit having coils ~~consisting of wound~~, obtained by a winding of magnet wire[[s]] and housed inside arranged on a stator sub-assemblies yoke, and pole teeth arranged on an inner ~~circumference thereof~~ periphery of the stator unit;
 - a rotor unit made of a resin material having with a field magnet arranged on an outer ~~circumference periphery thereof~~ periphery thereof ~~and~~, said rotor unit being rotatably disposed so as to oppose said pole teeth in a central portion of said stator unit with a given gap opposing said pole teeth;
 - an output shaft ~~attached to a center~~ arranged in the central portion of said rotor unit ~~and movable~~ so as to be slidable in ~~[[the]]~~ an axial direction thereof; and
 - ~~converting~~ conversion means made of a material having a small friction coefficient and sufficient abrasion resistance and provided on at least a portion of an inner[[most]] diametral circumferential surface side of said rotor unit ~~and adapted to for~~ converting rotary motion of said rotor unit into linear motion of said output shaft,
 - wherein ~~said converting means is made of a material different from that of said rotor unit~~ is integrally constituted by insert molding said field magnet and said conversion means.

2. (Currently amended) The linear type actuator as set forth in claim 1, wherein said conver[[ting]]sion means is configured with a plurality of straight sides and has corners thereof rounded.

3. (Canceled)

REMARKS

Applicants have now had an opportunity to carefully consider the Examiner's comments set forth in the Office Action of April 8, 2003. Reexamination and reconsideration are respectfully requested.

The Office Action

Acknowledgment was made to a claim for foreign priority under 35 U.S.C. §119(a)-(d) that all certified copies of the priority documents had been received and placed of record in the file.

Claims 1-3 were presented for examination.

Claims 1 and 2 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent number 5,595,089 issued to Watanabe et al. (Watanabe) in view of U.S. Patent number 6,464,421 B1 issued to Keifer and U.S. Patent number 5,829,119 A1 issued to Matsushita et al. (Matsushita).

Claim 3 stands objected to as being dependent upon a rejected base claim. This claim was said to be allowable if rewritten in independent form, including all of the limitations of the base claim and any intervening claims.

The Art Rejections**The Present Application:**

For purposes of a brief review, the present application is directed to providing a linear type actuator in which a rotor unit is manufactured by insert molding a nut serving as a motion converting means (which plays an important part in a linear type actuator), a field magnet and a magnet stopper. Such a design reduces the material cost and improves productivity, thereby achieving a cost reduction.

U.S. Patent No. 5,595,089 to Watanabe et. al.:

Watanabe is directed to reducing the size of an actuator for steering rear wheels, to simplify the construction thereof and to prevent a degradation in reliability. An actuator for steering rear wheels is disclosed that includes a cylindrically shaped housing member, a cylindrical coil member coaxially disposed within the internal space of the housing member,

a coil member around the inner wall of the housing member, a cylindrical rotor member disposed in a space located inside the coil member, a permanent magnet member mounted on the rotor member, a drive shaft member, and a motion conversion mechanism for converting a rotary motion from the former into a linear motion in the axial direction of the latter.

U.S. Patent No. 6,464,421 B1 to Keifer:

Keifer is directed to a jack extension tube, preferably for vehicles, which comprises a tube having a first section and a second section, the elongated tube made from a first material. A nut made from a second material less rigid than the first material is fixedly mounted in the first section, the nut having first and second opposed faces and a threaded bore therethrough. A jack screw is threadingly mounted for movement between a fully extended and a fully retracted position with respect to the nut.

U.S. Patent No. 5,829,119 to Matsushita et. al.:

Matsushita is directed to a stator assembly of a rotary electric device. The stator assembly comprises a yoke provided with a plurality of stationary magnetic poles and a yoke plate bonded to the yoke by means of synthetic resin in a mold to form an integral unit for enclosing a stator coil. A unitary stator assembly is produced.

The Present Application Distinguishes over the References:

In rejecting independent claim 1 as being unpatentable over Watanabe in view of Kiefer and in view of Matsushita, applicants respectfully submit that the Examiner used hindsight in dividing claim 1 into individual elements and then relying on the cited references to show that such elements are well known to those skilled in the art. Claim 1 of the present application, as amended, is directed toward solving a problem that is not taught or suggested in the cited references, and simply combining elements of the cited references does not arrive at the claimed invention.

The problems addressed by the present application are clearly defined on page 2, lines 3-19. First, the prior art female screw 52 as shown in Figure 1B necessarily has a small coefficient of friction, high wear resistance and dimensional stability. It follows that insert molding of the female screw requires a high-quality resin material which increases the cost of

the actuator. Second, because the molding conditions require high temperature and pressure, the workability of insert molding the female screw together with the field magnet 51 is deteriorated, and the insert molded product must be removed to form the female screw. The result is, again, increased cost because of the increased man hours necessary to produce the actuator. A further problem is an increase in man hours made necessary because the female screw is formed at the time of producing the rotor unit 50 which reduces the productivity of the insert molding process.

The object and the problems solved by the cited references are quite different than the above-stated problems that are solved by concepts of the present application as claimed in the amended claims. For example, Watanabe is concerned with a heating effect that occurs when a motor of reduced size is used to drive an actuator for steering rear wheels on an automobile (col. 1, lines 34-39). The solution taught by Watanabe is to locate the heat generating coil member outside the rotor where heat can be dissipated to the exterior through a housing member (col. 2, lines 55-64). While it is also a stated object of Watanabe to reduce the size of the actuator and to simplify its construction, Watanabe does not teach or suggest the features recited in claim 1 of the present application, and described in more detail below.

In particular, claim 1 includes a limitation for a rotor unit made of a resin material while the conversion means is made of a material having a small friction coefficient and sufficient abrasion resistance. This feature is neither taught nor suggested in the cited references, but is clearly supported in the present application (page 6, lines 1-6, page 7, lines 21-26 and page 8, lines 7-11). The claimed combination of materials in the rotor unit and the conversion means is a significant feature that patentably defines claim 1, as amended, over the cited references.

Further, claim 1, as amended, includes a limitation wherein the rotor unit is integrally constituted by insert molding the field magnet and the conversion means. This limitation has been included from claim 3 as originally filed, but canceled herein. It is noted that the Examiner indicated that claim 3 contained allowable subject matter.

Still further, claim 1, as amended, includes a conversion means on at least a portion of an inner diametral side of the rotor unit. This limitation offers technical and industrial advantages such as the reduced amount of expensive resin material as described in the present application on page 6, lines 9-13. Another advantage is described on page 7, lines 21-26,

where the converting means is described as being made of a resin material having a small coefficient of friction, high wear resistance and high dimensional stability. Support for the conversion means being located on at least a portion of an inner diametral side of the rotor unit is provided on page 8, line 27 to page 9, line 6.

For the foregoing reasons, it is respectfully submitted that claim 1, as amended, and claim 2 depending therefrom patentably distinguish over the cited art.

CONCLUSION

For the reasons detailed above, it is respectfully submitted that claims 1 and 2 of the present application are now in condition for allowance. An early notice to that effect is earnestly solicited.

Respectfully submitted,

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